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Estimation of gestational age in third trimester using mean fetal kidney length in comparison with fetal biometry

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Abstract
Background: Accurate estimation of gestational age (GA) is crucial for providing quality health care and need for intervention in inadvertent conditions such as fetal growth restriction. Various parameters are used for measuring GA, but none of them are valid in 3rd trimester. Recently some studies focused on Fetal kidney length (FKL) measurement for correct estimation of GA. This study focused on the validation of accuracy of FKL.
Objective: Estimation of gestational age in third trimester using mean foetal kidney length. Comparing the mean FKL with Biparietal diameter (BPD), Head circumference (HC), Abdominal circumference (AC), and Femur length (FL).
Methodology: Ultrasonography was done among 150 healthy antenatal with known Last menstrual period (LMP) in 3rd trimester to measure FKL, BPD, HC, AC, and FL.
Results: In the present study, 51.3% were of primi paras. With increased GA, FKL also increased. Regarding correlation, FKL had very strong correlation with GA than other indices.
Conclusion: FKL was the better parameter in estimating GA in 3rd trimester.

Keywords: Third trimester, ultrasonography, gestational age, fetal kidney length

Introduction
Appropriate gestational age (GA) measurement is necessary for improved antenatal care of all pregnancies. Management of Preeclampsia, intrauterine growth retardation, and gestational diabetes depends on correct estimation of GA [1]. Inability to assess GA accurately can contribute to iatrogenic prematurity or post maturity, which are linked to higher perinatal mortality and morbidity [2].
Measuring GA by using LMP may result in wrong calculations as some antenatal women report incorrect last menstrual periods (LMPs) and some have an irregular menstrual cycle. Hence Ultrasonography (USG) is crucial for measurement of GA [3, 4]. Estimation of GA by USG is most reliable in the first trimester and least accurate in the third trimester.
Sometimes, USG may give a higher GA to a large for gestational age foetus or a lesser GA to a small for gestational age foetus [4]. Currently no single parameter is there to calculate the exact foetal gestational age during the third trimester, particularly after the 34 weeks. This is of particular concern to obstetricians who treat pregnant women who come late, have the wrong LMP, or uncertain of their LMP [5, 6].
Except for urinary system anomalies such as obstructive uropathy in utero, foetal kidney is generally unaffected by foetal growth anomalies [7-9]. USG measured routine foetal biometrics are unreliable for assessing accurate GA after the 34 weeks of gestation [10]. As a result, the search for a single reliable biometric parameter that is more precise than the HC and FL between 20 and 34 weeks of pregnancy and can be more reliable than HC and FL between 34 and 40 weeks of pregnancy has begun. Foetal kidney length (FKL) estimation was observed to be more accurate than BPD, HC, FL, and AC from 24-38 weeks of pregnancy [11]. The purpose of this study is to estimate GA in 3rd trimester by using mean foetal kidney length in comparison with foetal biometry.

Aims & Objectives
Estimation of gestational age in third trimester using mean foetal kidney length. Comparing the mean FKL with BPD, HC, AC, and FL.

Materials and Methods

In this observational study, USG was done among 150 randomly selected healthy antenatal women with known gestational age from LMP in 3rd trimester to measure FKL (mean of both kidneys), BPD, HC, AC, and FL.

Inclusion criteria

1. Singleton pregnancies in the 3rd trimester (28 to 40 weeks)
2. Cases with known LMP
3. Antenatal without risk factors

Exclusion criteria

1. Anomalous fetuses
2. Suspected IUGR
3. Case with unknown LMP
4. Multiple gestation
5. Offspring of diabetic mothers
6. Renal pelvic dilatation of ≥5 mm

Statistical Methods

Statistical analysis was done using software SPSS software version 26.0 (Statistical Package for Social Sciences). Frequencies and percentages were calculated for all categorical variables. Correlation coefficient was used for analysis.

Results

In the present study, majority of cases were seen in 21-30 years age group (74%), followed by ≤20 years (14%), and 12% of cases were seen in >31 years.

In this study, majority of cases were primi paras (51.3%), and 48.7% were multi paras. (Table1).

In the figure 1, with increased gestational age, increased mean FKL was observed.

In the figure 2, HC showed linear growth with increased LMP GA. (r= 0.837).

In the figure 3, AC showed linear growth with increased LMP GA with r= 0.857.

In the figure 4, BPD showed linear growth with increased LMP GA with r= 0.834.

In the figure 5, increased FL was observed with increased LMP GA with r= 0.901.

In the figure 6, increased FKL was observed with increased LMP GA with r= 0.961.

In the table 2, BPD, HC, AC, FL, and FKL were significantly correlated with GA. Of them, FKL showed more positive correlation with GA. (r =0.961)

Discussion

Antenatal services are mainly based on GA. When correct GA is not known, especially among late registered, and in cases of unknown LMP, GA measurement becomes difficult. Biometric indices such as CRL, AC, BPD, HC, and FL fail to correctly estimate the GA after second trimester [12-14]. In these instances, FKL becomes a reliable indicator of GA [12].

Any variation in foetal growth can affect growth of all organs, even anterio-posterior and transverse diameter of kidney, but length of kidney is not affected, it remains almost same. In most of the cases, length of both kidneys is similar [15]. Despite that, in this study, mean of both kidneys was taken as FKL, to avoid any size differences in both kidneys.

Age distribution

In the present study, 74% of cases were seen in 21-30 years age group, followed by ≤20 years (14%), and >31 years (12%). This finding was contrast to the study by Akintomide AO *et al*., [3] in which 40% of cases were seen in 20-29 years, 58% of cases were observed in 30-39 years, and 2% of cases were seen in 40-44 years.

Parity

In the current study, majority of cases were primi paras (51.3%), and 48.7% of cases were multi paras. Contrast finding was reported in the study by Akintomide AO *et al*. [3], with 41% of multiparas, 30% of nullipara cases, and 29% of primipara cases.

GA and FKL

In the present study, with increasing GA, FKL also increased. In the present study mean FKL was 2.90 cm at 28 weeks, and of 3.92 cm length at 38 weeks, and FKL showed increased length along with increased GA. (Table 3)

In the study by Konje JC *et al*. [15], at 28 weeks mean FKL was 2.9 cm, which was similar to this study finding, with increased GA, FKL also increased, and at 38 weeks 4.01 cm was observed which was almost similar to this study finding. (Table 3)

In the study by Muthaian E *et al*. [16], at 28 weeks mean FKL was 2.81 cm, which was almost similar to this study finding, with increased GA, FKL also increased, and at 38 weeks 3.79 cm was observed which was in line with this study finding. (Table 3)

Sagi *et al*. study [17] reported lesser FKL than this study at 28 weeks (2.78 cm), but higher finding was observed at 38 weeks (4.03 cm). Mean FKL was increased throughout the GA. (Table 3)

In the study by Ahmadi *et al*. [18] higher findings were reported than this study finding. At 28 weeks mean FKL was 3.23cms, and at 38 weeks it was 4.25 cms. All the studies showed that with increased GA mean FKL also increased, which was similar to this study finding. (Table 3)

Correlation between GA and various parameters

BPD, HC, AC, FL, and FKL were significantly correlated with GA. Of them, FKL showed more positive correlation with GA than other parameters.

In the present study, correlation between GA and FKL was higher (r = 0.961), than GA and BPD (r = 0.834), GA and HC (r = 0.837), GA and AC (r= 0.857), GA and FL (r = 0.901).

In Muthaian E *et al*. study [16], GA and FKL correlation was higher (r = 0.962) than GA and BPD (r= 0.924), GA and HC (r = 0.902), GA and AC (r= 0.882), GA and FL (r = 0.950).

In Joshi BR *et al*. study, [19] correlation between GA and FKL was higher (r = 0.989) than GA and BPD (r = 0.986), GA and HC (r = 0.976), GA and AC (r = 0.971), GA and FL (r = 0.984).

Ugur *et al*. [20] reported GA and FKL correlation (r =0.947) was lesser than GA and BPD (r= 0.975), GA and HC (r =0.974), GA and FL (r=0.967), but higher than GA and AC (r = 0.852).

Gayam *et al*. [5] observed that GA and FKL correlation was higher (r = 0.991) than GA and BPD (r = 0.734), GA and HC (r = 0.836), GA and AC (r = 0.853), GA and FL (r = 0.853).

Ghaleb M.M *et al*. [6] mentioned that correlation between GA and FKL was higher (r = 0.951) than GA and BPD (r = 0.753), GA and HC (r= 0.810), GA and AC (r = 0.828), GA and FL (r = 0.884).

Above all the studies mentioned that correlation between FKL and GA is significant, and FSL is a good measure of GA.

Tables & Graphs

Table 1: Age and parity distribution

Parameter	Frequency	Percentage (%)
Age distribution (in years)		
≤20	21	14
21-30	111	74
>31	18	12
Parity		
Primi	77	51.3
Multi	73	48.7

Table 2: Correlation between LMP GA and various parameters

GA vs	Pearson's Correlation (r)	P value
BPD	0.834	<0.001*
HC	0.837	<0.001*
AC	0.857	<0.001*
FL	0.901	<0.001*
FKL	0.961	<0.001*

Table 3: Comparison of mean FKL (in Cms) at different gestational age in various studies

Gestational age (in weeks)	Present study	Konje JC *et al.* [15]	Muthaian E *et al.* [16]	Sagi *et al.* [17]	Ahmadi *et al.* [18]
28	2.90	2.90	2.81	2.78	3.23
30	3.13	3.09	3.02	3.05	3.52
32	3.31	3.32	3.20	3.33	3.74
34	3.47	3.50	3.42	3.60	3.97
36	3.72	3.82	3.66	3.82	4.08
38	3.92	4.01	3.79	4.03	4.25

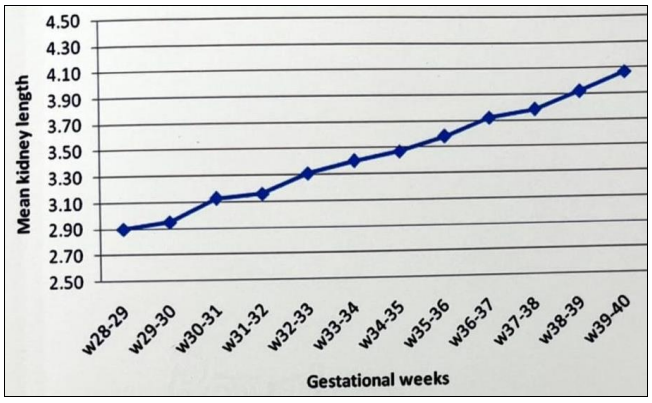

Fig 1: Mean fetal kidney length (FKL)

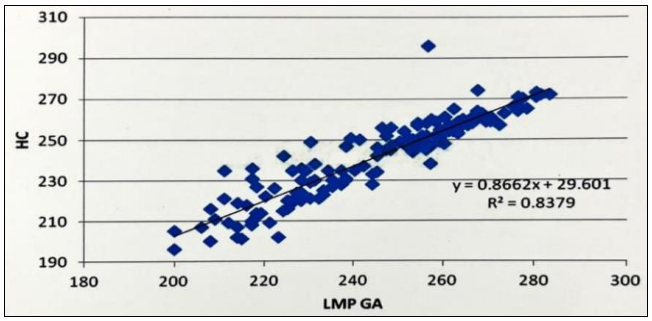

Fig 2: Correlation between LMP GA and HC

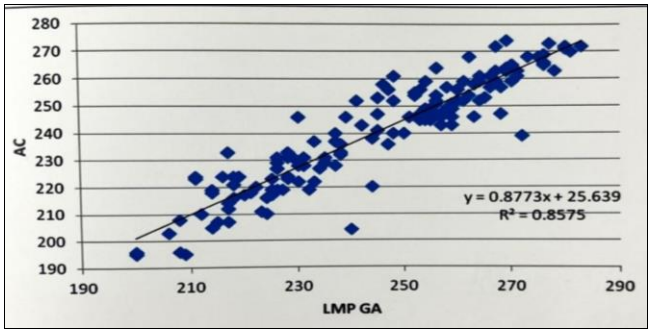

Fig 3: Correlation between LMP GA and AC

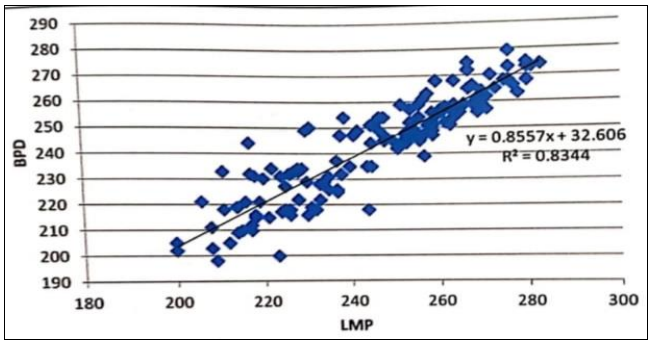

Fig 4: Correlation between LMP GA and BPD

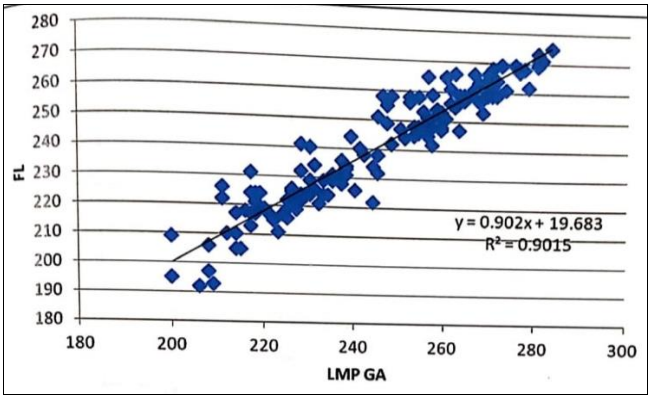

Fig 5: Correlation between LMP GA and FL

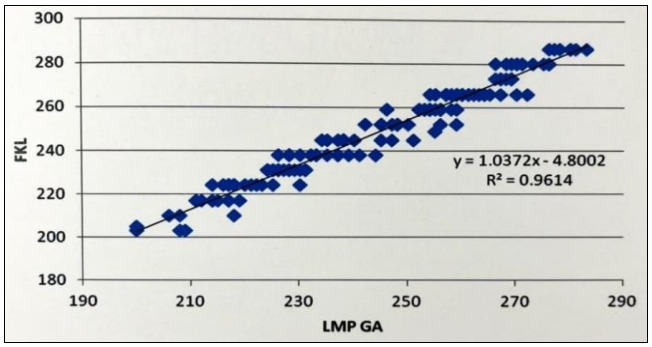

Fig 6: Correlation between LMP GA and FKL

Conclusion

In the present study, it was observed that FKL is a good and accurate indicator for measurement of GA, especially in third trimester. FKL correlated very strongly with GA compared to other parameters. Hence in third trimester, FKL can be used for better prediction of GA.

Conflict of Interest
Not available

Financial Support
Not available

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